Claims

[c1] 1. Novel ionic polymer metal composites manufactured by means of an innovative chemical depositing process, the process comprising the steps of: first depositing none noble metal salt cations inside a cationic ionic polymer molecular network followed by chemical reduction of the said none noble metal salt cations to generate reduced none noble metal particles deposited inside the polymeric molecular network and the outside surfaces of the polymeric material, like outside metallic electrodes, followed by a second electro or chemo deposition and plating of a noble metal inside and on surfaces of the said reduced none noble metal particles in the said polymer molecular network to protect the first said none noble metal particles from oxidation, corrosion and chemical degradation for prolonged sensing and actuation applications of the said novel ionic polymer metal composite material which generates an electrical signal with mechanical deformation and undergoes mechanical deformation if an electric field is imposed on it.

[c2] 2. The manufacturing processes for the novel ionic polymer metal composite material of claim 1, further comprising the steps of: first depositing none noble metal salt cations inside a cationic polymer molecular network and the outside surfaces of the polymeric material, like outside metallic electrodes, followed by chemical reduction of the said none noble metal salt cations to generate reduced none noble metal particles deposited inside the polymeric network, followed by a second electro or chemo deposition and plating of a noble metal inside and on surface of the said reduced none noble metal particles in the said polymer molecular network to protect the first said none noble metal particles from oxidation, corrosion and chemical degradation for prolonged sensing and actuation applications of the said novel ionic polymer metal composite material which generates an electrical signal with mechanical deformation and undergoes mechanical deformation if an electric field is imposed on it.

[c3] 3. The manufacturing processes for the novel ionic polymer metal composite material of claim 1, as described in claims 1 and 2 further comprising the steps of: adding dispersing chemicals to the said chemical reduction process, wherein said addition of a dispersing agent prevents reduced noble and none noble

metal particles to coalesce and helps forming uniformly distributed none noble metal particles chemically deposited inside the ionic polymer network and further helps them to penetrate deeper into the said ionic polymer molecular network.

[c4] 4. The manufacturing processes for the novel ionic polymer metal composite material of claim 1, as further described in claim 2 further comprising the steps of: adding an alcohol solvent to the reduction solution, wherein said addition of an alcohol solvent such as isopropyl alcohol and/or ethyl alcohol, helps expand the ionic polymer network and enhances deeper penetration of noble and none noble metal particles into said ionic polymer molecular network.

[c5] 5. The manufacturing processes for the novel ionic polymer metal composite material of claim 1, as further described in claim 2 further comprising the steps of: mechanically stretching the said ionic polymer before the start of manufacturing processes described in claims 1, 2, 3 and 4, wherein said mechanical stretching helps expand the ionic polymer network and enhances deeper penetration of noble and none noble metal particles into said ionic polymer molecular network.

[c6] 6. The novel ionic polymer metal composite of claim 1 to be used as electromechanical sensors in the sense that if they are mechanically moved or deformed they generate an electrical voltage across their surface electrodes. Typical values are that for a cantilever sample of such active materials of dimensions 20mmx5mmx0.2mm flipped at one end by 10mm, generates up to 10 mV across its surface electrodes.

[c7] 7. The novel ionic polymer metal composite of claim 1 to be used as electromechanical actuators, transducers and artificial muscles in the sense that if they are electrically activated by placing an electric field across their surface electrodes of the said cantilever sample in claim 6 as a bending actuator, they move or bend or flip dynamically like a wing with time varying electric fields. Typical values are that a cantilever sample of such active materials of dimensions 20mmx5mmx0.2mm placed in an electric field of 5mV/ μ m, generates a bending deflection of about 10mm at its free end.

[c8] 8. The novel ionic polymer metal composite material of claim1 further encapsulated inside a flexible polymeric membrane to keep it hermetically sealed and moist and to provide additional outside protection.